RADIOLARIA IN SURFACE SEDIMENTS FROM WEST CENTRAL PACIFIC NEAR TAIWAN (I)

YEN-NIEN CHENG AND KUEI-YU YEH
National Museum of Natural Science, Taichung, Taiwan 40419, R.O.C.

ABSTRACT—This is the first in a series of reports dealing with recent radiolarian studies for the west central Pacific near Taiwan. Based on the analyses of twenty six core tops, the results can be summerized as followings. (1) Radiolaria are rich in the fine-grain sediments from the basin to the southwest of Taiwan. (2) The major radiolarian components of each sample are similar to one another at generic level. (3) All the radiolarian assemblages are characterized by having distinct tropical forms and some subtropical taxa. (4) In the basin along the eastern coast of Taiwan, sediments containing radiolaria were mostly collected from the southern part. According to the previous workers, this area could be an upwelling zone.

INTRODUCTION

During the last three decades, there are tremendous studies dealing with Cenozoic Radiolaria of the tropical oceans (i.e., Ling and Anikouchine, 1967; Nigrini, 1967, 1968, 1971, 1977; Hays, et al., 1969; Petrushvskaya, 1971a, 1971b; Dumitrica, 1973; Renz, 1976; Riedel and Sanfilippo, 1971, 1978; Casey, et al., 1979; and Takahashi and Honjo, 1981). However, Radiolaria of the west central Pacific near Taiwan remain poorly understood.

This is the first in a series of reports on Recent radiolarian studies for the marginal basins near southern Taiwan. The present study is primarily on the radiolarian analyses for the core tops from two areas within the pathway of the Kuroshio.

Location and Sample Information

In this report, samples for analysis include five box cores, twelve gravity cores, and nine piston cores. They were taken in two cruises (March 30 to April 2, 1987; June 28 to July 1, 1987) made by the "Ocean Researcher"—a research ship of National Science Foundation of Taiwan. Most samples were taken along the eastern coast of Taiwan (Area I, see text-figure 1). Only two samples were cored from the basin (Area II, see text-figure 1) to the southwest of Taiwan. The major information of these samples are in the list of Text-figure 2.

Geographically, these two research areas connect to each other at the "Bashi Channel" (or the Luzon Strait). The warm water Current of the Kuroshio branches at the Bashi Channel and are runing respectively through these two areas.

RESULTS AND DISCUSSION

Nearly twenty families and ninety distinct radiolarian forms have been observed from twenty six cores. Only seventy one taxa were identified and figured in this report. Text-figure 3 shows the relative abundance and occurrence of these taxa.

Well preserved and highly diversified radiolaria occur in some samples of fine grain sediments. The samples bearing radiolaria are of depth ranging from 1000 meters to 4250 meters (i.e., OR-87-01-11, OR-87-01-13, OR-87-01-14, OR-87-02-01, and OR-87-02-02). Samples barren of radiolaria are those from shallow shelf and of coarse grains in nature (i.e., ST5, ST6 and ST7).

Radiolaria in the samples from "Area II" are extremely high in concentration. However, those in the samples from "Area I" are less abundant. If only taking samples with well-preserved radiolaria into account, the assemblages from both areas are closely similar to each other at generic level. The characteristics of these assemblages in common include:

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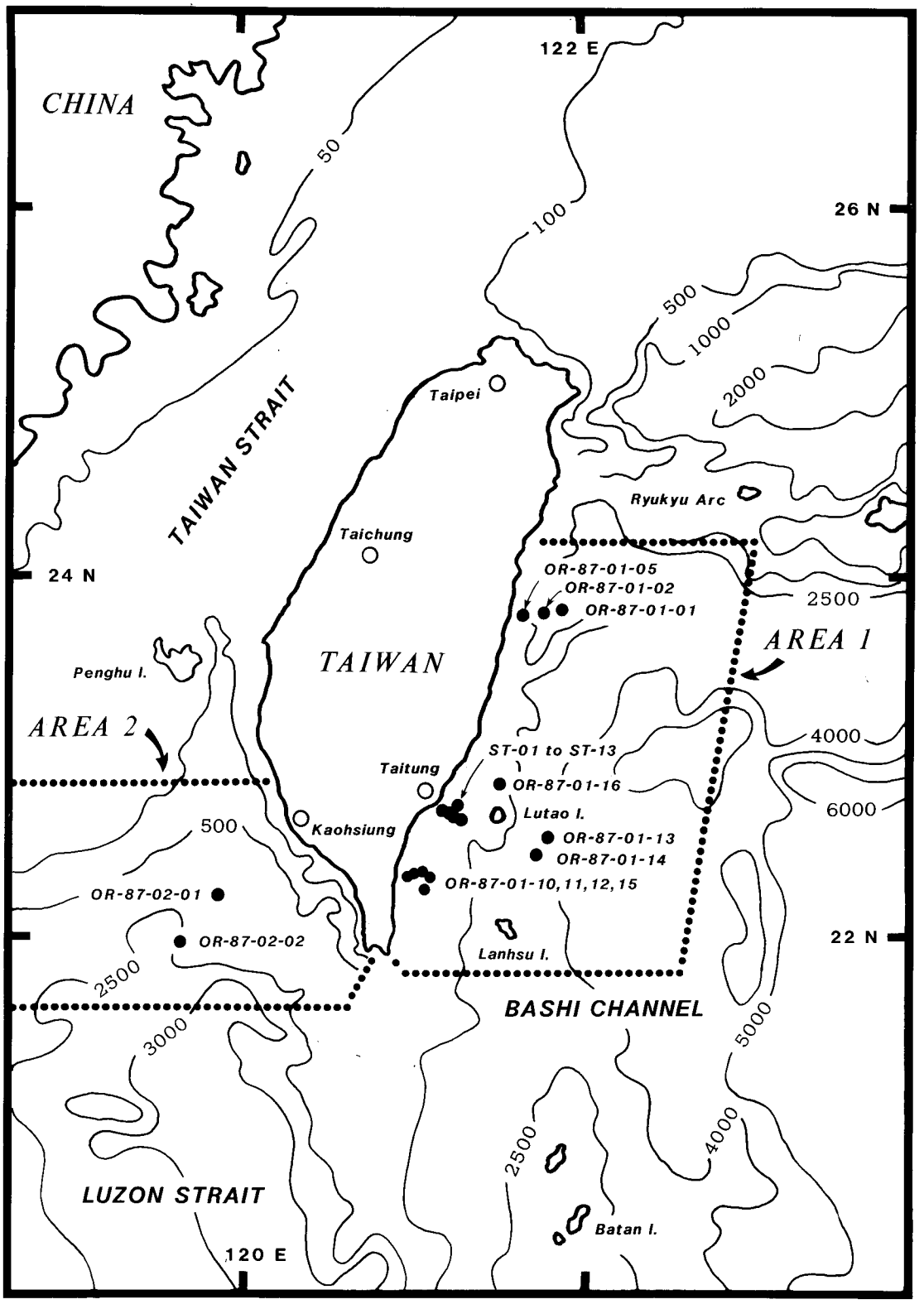

Text-fig. 1. Index map showing sample location.

Core designation	Lat. (N)	Long. (E)	Water depth(m.)	Lithology	Radiolaria relative abundance	Preservation
ST1G *	22, 43	121, 11	214	Mud	rare	fair
ST2G	22, 44	121, 12	171	Mud	rare	fair
ST3B	22, 43	121, 10	152.6	Mud	rare	fair
ST4B	22, 45	121, 13	131.5	Reef	rare	fair
ST5B	22, 45	121, 12	110.5	Sand, pebbles	barren	—
ST6B	22, 44	121, 09	21.8	Sand	barren	—
ST7B	22, 43	121, 09	20.7	Sand, Pebbles	barren	—
ST8G *	22, 44	121, 15	935	Mud	common	fair
ST9G	22, 43	121, 12	520	Mud	barren	—
ST10G	22, 43	121, 11	250	Mud	common	fair
ST11G	22, 43	121, 12	200	Mud	common	fair
ST12G *	22, 43	121, 13	710	Mud	abundant	good
ST13G *	22, 43	121, 17	1130	Mud	abundant	good
OR-87-01-01G *	23, 52	121, 47	3800	Mud	rare	poor
OR-87-01-02G	23, 52	121, 43	2600	Mud	rare	poor
OR-87-01-05G *	23, 51	121, 39	826	Mixed mud	rare	poor
OR-87-01-10G *	22, 21	121, 03	1160	Mixed mud	rare	poor
OR-87-01-10P	22, 21	121, 03	1160	Mixed mud	rare	poor
OR-87-01-11P *	22, 22	121, 05	1105	Mixed mud	abundant	excellent
OR-87-01-12P *	22, 22	121, 04	1120	Mud	rare	poor
OR-87-01-13P *	22, 35	121, 47	4200	Mud	abundant	excellent
OR-87-01-14P *	22, 31	121, 41	4250	Mud	abundant	excellent
OR-87-01-15P	22, 19	121, 05	1167	Mixed mud	rare	fair
OR-87-01-16P	22, 55	121, 32	1907	Mixed mud	rare	fair
OR-87-02-01P *	22, 14	119, 53	1328	Mud	abundant	excellent
OR-87-02-02P *	21, 59	119, 40	2335	Mud	abundant	excellent

Text-fig. 2. Sample information. In first column, B: box core, G: gravity core, P: piston core, *: core selected for faunal analyses.

⁘ : abundant 6 specimens ⁖ : common 3 to 5 specimens o : rare 1 to 2 specimens	AREA I										A. II	
	ST1	ST8	ST12	ST13	OR-87-01-05	OR-87-01-10	OR-87-01-11	OR-87-01-12	OR-87-01-13	OR-87-01-14	OR-87-02-01	OR-87-02-02
Actinomma arcadophora	o	⁖	⁖	⁘			⁖		⁖			⁘
Heliosoma radians	o	o	⁖	⁖			⁖					
Hexacontium axotrias			⁖				⁘		⁘	⁖	⁖	⁘
Hexalonche aristarchi			o				o		⁖	⁖	⁖	⁖
Ommatartus tetrathalamus		⁖	⁘		o		⁘		⁖	⁖	⁘	⁘
Ommatartus sp. A			o				⁘			⁖	⁘	⁖
Ommatartus sp. B	o		o		o		o		o	o	⁖	⁘
Astrosphaera hexagonalis			o									
Heliodiscus asteriscus			⁖				⁖			⁘	⁖	⁘
Heliodiscus echiniscus		o	o			o	⁖	o			⁖	
Acrosphaera spinosa			⁖				⁖		⁘	⁘	⁘	⁘
Collosphaera invaginata							o		o		⁖	
Siphonosphaera polysiphonia							⁖		⁘	⁘	⁘	⁘
T. megalactis megalactis			o				⁖			⁖	⁘	⁘
Larcopyle sp. cf. L. butschlii											⁖	
Amphirhopalum virchowii				o								
Amphirhopalum ypsilon			o								⁖	
Amphimeniam sp. A							o		o		⁖	
Euchitonia elegans	o		⁖	⁖		⁖	⁘	⁖	⁘	⁘	⁘	⁘
Euchitonia furcata			⁖	⁖		⁖	⁖		⁘	⁘	⁘	⁘
Euchitonia sp. A									o		⁘	
Euchitonia sp. B	o		⁖				⁖		⁖	⁘	⁘	
Euchitonia sp. C			⁖				⁖		⁖	⁘	⁖	
Hymeniastrum euclidis	o		⁖	⁖		o	⁖		⁘	⁘	⁖	⁘

Text-fig. 3. Occurrance and relative abundance of Radiolaria in twelve selected core tops.

(Continued)

⁘ : abundant 6 specimens ⁖ : common 3 to 5 specimens o : rare 1 to 2 specimens	AREA I										A.II	
	ST1	ST8	ST12	ST13	OR-87-01-05	OR-87-01-10	OR-87-01-11	OR-87-01-12	OR-87-01-13	OR-87-01-14	OR-87-02-01	OR-87-02-02
Hymeniastrum sp. A	o	⁖	⁖	⁖			⁘		⁖	⁘	⁘	⁘
Hymeniastrum sp. B	o		⁖				⁘		⁘	⁘	⁘	⁖
Hymeniastrum sp. C										⁘		⁖
Hymeniastrum(?) sp. D			o	o								
Hymeniastrum sp. E			⁖	⁖			⁖			⁘	⁘	⁘
Ommastodiscus murrayi			⁖				⁖		⁖	⁘	⁘	
Octopyle stenozoa	o						⁖		⁖	⁘	⁘	⁘
Octopyle sp. cf. O. stenozoa			o								⁖	⁖
Tetrapyle octacantha			o				⁖		o		⁖	⁘
Tetrapyle sp. A							⁖			o	⁖	⁖
Spongaster tetras tetras	o		⁖	⁖		⁖	⁘		⁖	⁘	⁖	⁘
Spongaster berminghami								o		o	o	o
Spongaster sp. A			o									
Spongocore puella			⁖							⁘	⁘	⁘
Spongodiscus resurgens	o		⁘	o		⁖	⁘	⁖	⁖		⁘	
Acanthodesmia vinculata			o	o	o	o	⁖		⁖	⁖	⁘	⁘
Amphispyris costata			o				o			o	⁖	⁖
Amphispyris sp. A		o	o				⁘				⁖	⁖
Amphispyris sp. B							o			o		
Amphispyris sp. C			o				o				⁖	o
Amphispyris sp. D			o							o	o	
L. pentagona pentagona			⁖									
Nephrospyris renilla											⁖	⁘
Tristephanium sp. A			o									

(Continued)

⁘ : abundant 6 specimens ⁖ : common 3 to 5 specimens ○ : rare 1 to 2 specimens	AREA I										A. II	
	ST1	ST8	ST12	ST13	OR-87-01-05	OR-87-01-10	OR-87-01-11	OR-87-01-12	OR-87-01-13	OR-87-01-14	OR-87-02-01	OR-87-02-02
Tristephanium sp. B											○	○
Litharachnium sp. A	○											
Botryostrobus seriatus										○	⁘	⁘
Spirocyrtis scalaris			○				○					
Conoarachnium facetum												○
Callimitra sp. A			○									○
Vertiellata hexacantha			○	○		○	○					
Anthocyrtidium ophirensis							⁘		⁖	⁖	⁖	⁘
Anthocyrtidium zanguebaricum							⁖	⁖	⁖			
Eucyrtidium acuminatum											⁘	⁘
Eucyrtidium cienkowskii	○		⁖	⁖			⁘	⁖		⁖	⁖	
Lithopera becca			○						○	○	⁘	
Pterocory campanula							⁘			⁘	⁘	⁘
Pterocory sp. A			○	○								
Theocorythium trachelium			⁖				⁘	⁖	⁖	⁘	⁖	⁘
Sethophormis sp. A		○										
Eucecryphalus geganbauri				○			○				⁖	⁖
Lampromitra quadricuspis	○											
Lampromitra coronata			○	○			○	○			⁖	⁖
Cecryphalium sestrodiscum	○										⁘	⁘
Stichopodium dictyopodium				⁖		⁖	⁖		⁖	⁘	⁘	⁘
Pterocanium paetextum	○		⁖	⁖		⁖	⁘		⁘	⁖	⁘	⁘
Pterocanium orcinum			○				⁖		⁖	⁖	⁘	⁘
Pterocanium virgineum			○	⁖								⁖

(1) the frequent occurrence of tropical forms such as *Heliodiscus echiniscus, Acrosphaera spinosa, Collosphaera invaginata, Siphonosphaera polysiphonia, Trisolenia megalactis megalactis, Euchitonia elegans,* and *Lithopera becca,* etc.;
(2) common subtropical taxa such as *Sethophormis* spp., *Eucecryphalus geganbauri, Lampromitra quadricuspis, Lampromitra coronata,* and *Cecryphalium sestrodiscum,* etc.;
(3) abundant cosmoporitan taxa including *Hexacontium axotrias, Hexalonche aristarchi, Ommatartus tetrathalamus, Hymeniastrum* spp., *Octopyle* spp., *Ommatodiscus murrayi, Spongodiscus resurgens, Acathodesmia vinculata,* and *Pterocanium praetextum praetextum,* etc..

In "Area I", the radiolaria are mostly present in the fine sediments from the southern area. The differences in organic content of sediments are possibly due to the variation of depositional environments. According to Tominaga (1972), the upwelling cold water occurred frequently in the southern part of "Area I". The surface sediments of this area often contain abundant radiolaria.

PALEONTOLOGIC NOTES

Order POLYCYSTINA Ehrenberg, 1838, emend. Riedel, 1967a
Suborder SPUMELLARIA Ehrenberg, 1875

Family ACTINOMIDAE Haeckel, 1862, emend. Riedel, 1971

Genus ***Actinomma*** Haeckel, 1860a
Actinomma arcadophorum Haeckel
Plate 8, figures 16, 17
Actinomma arcadophorum Haeckel, 1887, P.255, Pl.29, figs.7-8,—Takahashi and Honjo, 1981, P.147, Pl.2, fig.5

Genus ***Heliosoma*** Haeckel, 1882
Heliosoma radians Haeckel
Plate 1, figure 16
Heliosoma radians Haeckel, 1887, P240, Pl. 28, fig.3

Genus ***Hexacontium*** Haeckel, 1881
Hexacontium axotrias Haeckel
Plate 8, figure 6
Hexacontium axotrias Haeckel, 1887, P192, Pl.24, fig.3,—Takahashi and Honjo, 1981, P.148, Pl.3, fig.14

Genus ***Hexalonche*** Haeckel, 1881
Hexalonche aristarchi Haeckel
Plate 1, figure 8
Hexalonche aristarchi Haeckel, 1887, P.185, Pl.22, fig.3

Genus ***Ommatartus*** Haeckel, 1881
Ommatartus tetrathalamus (Haeckel)
Plate 2, figure 1; Plate 5, figures 1-2; 5-6, 10
Penartus tetrathalamus Haeckel, 1887, P.378, Pl.40, fig.3—Riedel and Sanfilippo, 1971, Pl. 1c, figs. 5-7

Ommatartus sp. A
Plate 5, figures 3-4

Ommatartus sp. B
Plate 2, figure 5; Plate 5, figures 7-9, 13

Family ASTROSPHAERIDAE Haeckel, 1882, emend. Campbell, 1954
Subfamily ASTROSPHAERINAE Haeckel, 1882

Genus ***Astrosphaera*** Haeckel, 1887
Astrosphaera hexagonalis Haeckel, 1887
Plate 8, figure 13
Astrosphaera hexagonalis Haeckel, 1887, P.250, Pl. 19, fig. 4

Family COCCODISCIDAE Haeckel, 1862, emend. Riedel, 1967
Subfamily PHACODISCINAE Haeckel, 1881

Genus ***Heliodiscus*** Haeckel, 1862
Heliodiscus asteriscus Haeckel
Plate 1, figure 5; Plate8, figure 12
Heliodiscus asteriscus Haeckel, 1887, P. 445, Pl. 33, fig. 8

Heliodiscus echiniscus Haeckel
Plate 1, figure 4
Heliodiscus echiniscus Haeckel, 1887, P. 448, Pl. 34, fig. 5

Family COLLOSPHAERIDAE Muller, 1858a

Genus ***Acrosphaera*** Haeckel, 1881
Acrosphaera spinosa (Haeckel)
Plate 1, figures 9, 17; Plate 8, figure 14
Collosphaera spinosa Haeckel, 1860b, P. 845; 1862; P. 536, Pl. 34, figs. 12, 13.
Polysolenia spinosa (Haeckel). Nigrini, 1967, P. 14, Pl. 1, fig. 1

Acrosphaera spinosa (Haeckel). Takahashi and Honjo, 1981, P. 144-145, Pl. 1, fig. 6

Genus ***Collosphaera*** Muller, 1855
Collosphaera invaginata (Haeckel)
Plate 1, figure 11; Plate 8, figure 10
Buccinosphaera invaginata Haeckel, 1887, P.99, Pl. 5, fig. 11
Collosphaera invaginata (Haeckel). Bjorklund and Goll, 1979. Pl. 1317, Pl. 3, figs. 1-9

Genus ***Siphonosphaera*** Muller, 1858a
Siphonosphaera polysiphonia Haeckel
Plate 1, figure 12
Siphonosphaera polysiphonia Haeckel, 1887, P. 106, — Takahashi and Honjo, 1981, P. 145, Pl. 1, fig. 8

Genus ***Trisolenia*** Ehrenberg, 1860
Trisolenia megalactis megalactis (Ehrenberg)
Plate 8, figure 18
? *Tetrasolenia quadrata* Ehrenberg, 1872, Pl. 10, fig. 20; 1873, P. 320
Trisolenia megalactis megalactis (Ehrenberg). Bjorklund and Goll, 1979. P.1321, Pl. 5, figs. 1-21

Family LITHELLIDAE Haeckel, 1862

Genus ***Larcopyle*** Haeckel, 1887
Larcopyle sp. cf. ***L. butschlii*** Dreyer
Plate 1, figures 6, 13
Larcopyle butschlii Dreyer, 1889, Pl. 10, fig. 10, — Takahashi and Honjo, 1981, P. 150, Pl. 5, fig. 15

Family PORODISCIDAE Haeckel, 1881, emend. Petrushevskaya and Kozlova, 1972

Genus ***Amphirhopalum*** Haeckel, 1881
Amphirhopalum virchowii (Haeckel)
Plate 6, figure 12
Euchitonia virchowii Haeckel, 1887, P.522; Nigrini, 1967, P.35, Pl.3, figs. 3a-d

Amphirhopalum ypsilon Haeckel
Plate 1, figures 1, 7; Plate 6, figure 8
Amphirhopalum wyvilleanum Haeckel, 1887, P.523, Pl. 45, fig. 12
Amphirhopalum ypsilon Haeckel, 1887, P. 522,— Nigrini, 1967, P. 35, Pl. 3, figs. 3a-3d

Genus ***Amphymenium*** Haeckel
Amphymenium sp. A
Plate 1, figures 2, 10

Genus ***Euchitonia*** Ehrenberg, 1860b, emend. Haeckel, 1887
Euchitonia elegans (Ehrenberg)
Plate 3, figures 6, 14, 17; Plate 6, figures 7, 13
Pteractis elegans Ehrenberg, 1872, P. 319; 1872b, P. 299, Pl. 8, fig. 3
Euchitonia elegans (Ehrenberg)—Haeckel, 1887, P.535

Euchitonia furcata Ehrenberg
Plate 3, figures 2, 18; Plate 6, figure 5
Euchitonia furcata Ehrenberg, 1861a, P.767;—1861b, ibid., P. 823,—Ling and Anikouchine, 1967, P. 1484, Pl. 189, figs. 1, 2; Pl. 190, figs. 1-2

Euchitonia sp. A
Plate 3, figure 1

Euchitonia sp. B
Plate 6, figures 2, 3, 4
Remarks: This form was assigned to *E. elegans* (Ehrenberg) (Ling and Anikouchine, 1967, Pl. 189, figure 3; Pl. 190, fig. 3). However this form is differs from *E. elegans* (Ehrenberg) by having a relatively larger cortical shell and three relatively shorter and thicker rays.

Euchitonia sp. C
Plate 6, figure 6
Euchitonia furcata Ehrenberg, Ling and Anikouchine, 1967, Pl. 189, figs. 5-7; Pl. 190, figs. 5-7

Genus ***Hymeniastrum*** Ehrenberg, 1947a
Hymeniastrum euclidis Haeckel
Plate 3, figures 7, 11-13; Plate 6, figure 11
Hymeniastrum euclidis Haeckel, 1887, P. 531, Pl. 43, fig. 13

Hymeniastrum sp. A
Plate 3, figures 4-5, 15; Plate 6, figure 10

Hymeniastrum sp. B
Plate 3, figures 8-9, 15; Plate 6, figure 9

Hymeniastrum sp. C
Plate 3, figure 19

Hymeniastrum (?) sp. D
Plate 6, figure 14
Remarks: This form is questionably assigned to *Hymeniastrum* sp. by having a poorly developed three rayed test covered by patagium with very

coarse spongeous pore frames.

Hymeniastrum sp. E
Plate 6, figures 15-16
Hymeniastrum euclidis Haeckel, Takahashi and Honjo, 1981, Pl. 5, fig. 5

Genus ***Ommatodiscus*** Stohr, 1880
Ommatodiscus murrayi Dreyer
Plate 1, figures 15, 18; Plate 10, figures 14, 15
Ommatodiscus murrayi Dreyer, 1889, Pl. 9, fig. 56

Family PYLONIIDAE Haeckel, 1881

Genus ***Octopyle*** Haeckel, 1881
Octopyle stenozona Haeckel
Plate 7, figures 1-2
Octopyle stenozona Haeckel, 1887. P. 652, Pl. 9, figure 11

Octopyle sp. cf. ***O. stenozona*** Haeckel
Plate 7, figures 3-6
Octopyle stenozona Haeckel. Takahashi and Honjo, 1981. Pl. 6, fig. 7
Remarks: This form is slightly different from *O. stenozona* Haeckel by having a test more elongate in dorsal view.

Genus ***Tetrapyle*** Muller, 1858b
Tetraphyle octacantha Muller
Plate 2, figures 3, 7, 16
Tetrapyle octacantha Muller, 1858a, P. 33, figs. 1-6

Tetrapyle sp. A
Plate 2, figure 10

Family SPONGODISCIDAE Haeckel, 1862, emend. Riedel, 1967

Genus ***Spongaster*** Ehrenberg, 1860b
Spongaster tetras tetras Ehrenberg
Plate 3, figures 16, 20; Plate 6, figure 17
Spongaster tetras Ehrenberg, 1872b, P. 299, Pl. 6, fig. 8
Spongaster tetras tetras Ehrenberg. —Nigrini, 1967, P. 41, Pl. 5, figs. 1a, 1b

Spongaster berminghami Campbell and Clark
Plate 1, figure 3
Spongaster berminghami Campbell and Clark, 1944, P. 30, Pl. 5, figs. 1-2

Spongaster sp. A
Plate 8, figure 11

Genus ***Spongocore*** Haeckel 1887
Spongocore puella Haeckel
Plate 3, figures 3, 10; Plate 6, figure 1
Spongocore puella Haeckel, 1887, P. 347, Pl. 48, fig. 6

Genus ***Spongodiscus*** Ehrenberg, 1854
Spongodiscus resurgens Ehrenberg
Plate 1, figure 19; Plate 8, figure 15
Spongodiscus resurgens Ehrenberg, 1854, P. 240—Haeckel, 1887, P. 577

Spumellaria gen. and sp. indet. A
Plate 1, figure 14

Suborder NASSELLARIA Ehrenberg, 1875
Family ACANTHODESMIIDAE Haeckel, 1862

Genus ***Acanthodesmia*** Muller, 1857
Acanthodesmia vinculata Muller
Plate.10, figures 3-4, 7-8
Lithocircus vinculata Muller, 1857, P. 487

Genus ***Amphispyris*** Haeckel
Amphispyris costata Haeckel
Plate 2, figures 8, 11
Amphispyris costata Haeckel, 1887, P. 1097, Pl. 88, fig. 3

Amphispyris sp. A
Plate 2, figures 9, 13; Plate 7, figures 7-11

Amphispyris sp. B
Plate 2, figures 17, 18; Plate 8, figures 9

Amphispyris sp. C
Plate 2, figures 6, 14; Plate 8, figures 7, 8

Amphispyris sp. D
Plate 7, figures 12-15

Genus ***Lophospyris*** Haeckel, 1881, emend. Goll, 1976
Lophospyris pentagona pentagona (Ehrenberg)
Plate 5, figures 11-12, 14-16
Dorcadospyris pentagona Ehrenberg. 1872a, P. 303; 1872b, P. 302, Pl. 5, fig. 15,—Goll, 1969, pp. 338-339, Pl. 59, figs. 1-3, 5 (not 8-10, 12) (synonym),—Goll, 1972a, pp. 964-965, Pl. 58, figs. 1-3, Pl. 88
Lophospyris pentagona pentagona (Ehrenberg)—Goll,

1976, pp. 384, 398, Pl. 10, figs. 1-7; Pl. 11, figs. 1-3, 5

Genus ***Nephrospyris*** Haeckel, 1887
Nephrospyris renilla Haeckel
Plate 2, figures 12, 15
Nephrospyris renilla Haeckel, 1887, P. 1101, Pl. 90, figs.9-10—Goll, 1972, P. 967, 1034.

Genus ***Tristephanium*** Haeckel, 1882
Tristephanium sp. A
Plate 2, figure 2

Tristephanium sp. B
Plate 2, figure 4

Family ARCHIPHORMIDIDAE Haeckel, 1882, emend. Campbell, 1954
Subfamily ARCHIPHORMIDINAE Haeckel, 1882, emend. Campbell, 1954

Genus ***Litharachnium*** Haeckel, 1860
Litharachnium sp. A
Plate 4, figures 15, 19-20; Plate 11, figures 9-11

Family ARTOSTROBIIDAE Riedel, 1967b, emend. Foreman, 1973

Genus ***Botryostrobus*** Haeckel, 1887, emend. Nigrini, 1977
Botryostrobus Haeckel, 1887, P. 1475; Nigrini, 1977, P. 243

Botryostrobus seriatus (Joergensen)
Plate 8, figures 1,2
Botryostrobus seriatus(Joergensen).—Poluzzi, 1982, P. 67, Pl. 28, figs. 1-4

Genus ***Spirocyrtis*** Haeckel, 1887
Spirocyrtis scalaris Haeckel
Plate 9, figure 17
Spirocyrtis scalaris Haeckel, 1887, P. 1509, Pl. 76, fig. 14

Artostrobids gen. and sp. indet. A
Plate 8, figure3

Family LOPHOPHAENIDAE Haeckel, 1882, emend. Campbell, 1954
Subfamily LOPHOPHAENINAE Haeckel, 1882, emend. Campbell, 1954

Genus ***Conarachnium*** Haeckel, 1882
= *Sethoconus* Haeckel, 1887
Conarachnium facetum (Haeckel)
Plate 4, figure 7
Sethoconus facetus Haeckel, 1887, P. 1296, Pl. 55, fig. 1

Family PLAGONIIDAE Haeckel, 1881, emend. Riedel, 1967b

Genus ***Callimitra*** Haeckel, 1881

Callimitra sp. A
Plate 4, figure 6; Plate 10, figure 16

Family PLECTANIIDAE Haeckel 1882, emend. Campbell, 1954
Subfamily PLECTANIINAE Haeckel 1882, emend. Campbell, 1954

Genus ***Verticillata*** Popofsky, 1913
Verticillata hexacantha Popofsky
Plate 9, figures 7-8

Family PTEROCORYTHIDAE Haeckel, 1881, emend. Riedel 1967, emend. Moore 1972

Genus ***Anthocyrtidium*** Haeckel, 1881
Anthocyrtidium ophirense (Ehrenberg)
Plate 10, figures 5-6

Anthocyrtidium zanguebaricum (Ehrenberg)
Plate 10, figures 1-2

Genus ***Eucyrtidium*** Ehrenberg
Eucyrtidium acuminatum (Ehrenberg)
Plate 8, figures 4, 5
Lithocampe acuminate Ehrenberg, 1844a, P. 84—Nigrini, 1967, P. 81, t. 8, f. 3

Eucyrtidium cienkowskii Haeckel
Plate 4, figures 4-5; Plate 9, figures 13-16

Genus ***Lithopera*** Ehrenberg, emend. Nigrini, 1967
Lithopera becca Ehrenberg
Plate 4, figures 14, 18

Genus ***Pterocorys*** Haeckel, 1881
Pterocorys Haeckel, 1881, P. 435

Pterocorys campanula Haeckel
Plate 9, figures 11-12
Pterocorys campanula Haeckel, 1887, P. 1316, Pl. 71,

fig. 3

Pterocorys sp. A
Plate 10, figures 9-10

Genus ***Theocorythium*** Haeckel, 1887
Theocorythium trachelium (Ehrenberg)
Plate 10, figures 11-13
Theocorythium trachelium trachelium (Ehrenberg), Nigrini and Moore, 1979, P. N93, Pl. 26, fig. 2
Remarks: The figures show a broken speciemen of *T. trachelium*

Family SETHOPHORMIDIDAE Haeckel, 1881
Genus ***Sethophormis*** Haeckel, 1881

Sethophormis sp. A
Plate 10, figure 17

Family SETHOPILLIIDAE Haeckel, 1882, emend. Campbell, 1954
= *Tripocyrtida* Haeckel, 1887

Genus ***Eucecryphalus*** Haeckel, 1862
Eucecryphalus geganbauri Haeckel
Plate 4, figures 13, 17; Plate 11, figure 13

Genus ***Lampromitra*** Haeckel, 1882
Lampromitra quadricuspis Haeckel
Plate 4, figures 10, 11; Plate 11, figures 1-3
Lampromitra quadricuspis Haeckel, 1887, P. 1214, Pl. 58, fig. 7

Lampromitra coronata Haeckel
Plate 4, figure 16; Plate 11; figures 4, 8, 12
Lampromitra coronata Haeckel, 1887, P. 1214, Pl. 60, fig. 7

Family THEOCORYTHIDAE Haeckel, 1882, emend. Campbell, 1954
Subfamily THEOCORYTHINAE Haeckel, 1882, emend. campbell, 1954

Genus ***Cecryphalium*** Haeckel, 1882
Cecryphalium sestrodiscus Haeckel
Plate 4, figures 8, 12; Plate 11, figures 5-7, 14-16
Cecryphalium sestrodiscus Haeckel, 1887, P. 1399, Pl. 58, fig. 1
Subfamily THEOCAPSINAE Haeckel, 1882, emend. Campbell, 1954

Genus ***Stichopodium*** Haeckel, 1882

Stichopodium dictyopodium Haeckel
Plate 4, figure 9
Stichopodium dictyopodium Haeckel, 1887, Pl 1147, Pl. 75, fig. 6

Family THEOPERIDAE Haeckel, 1881, emend. Riedel, 1967

Genus ***Pterocanium*** Ehrenberg, 1847
Pterocanium praetextum praetextum (Ehrenberg), 1872
Plate 4, figure 1; Plate 9, figures 3-6
Pterocanium praetextum praetextum (Ehrenberg), Nigrini and Moore, 1979, P.N41, Pl. 23, fig. 2

Pterocanium orcinum Haeckel
Plate 4, figure 3; Plate 9, figures 9-10
Pterocanium orcinum Haeckel, 1887, P. 1329, Pl. 73, fig. 2

Pterocanium virgineum Haeckel
Plate 4, figure 2; Plate 9, figures 1-2
Pterocanium virgineum Haeckel 1887, P. 1330, Pl. 73, fig. 6

ACKNOWLEDGEMENTS

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臺灣南部海域表層沉積物放射蟲之研究(Ⅰ)

程延年　葉貴玉

摘　要

本論文乃針對臺灣鄰近海域放射蟲所作之系列研究的第一期成果報告。根據臺東外海及高雄外海總共二十六個岩心頂部沉積物所作的放射蟲分析，我們發現：

㈠高雄外海表層沉積物之放射蟲含量遠比臺東外海豐富；

㈡臺東外海沉積物中之放射蟲雖然含量較低，但族群之組合與高雄外海大致相似；

㈢兩區之放射蟲族群皆含有數量相當明顯的熱帶種及數量較少的亞熱帶種；

㈣東部海域的放射蟲分布在花蓮附近極爲稀少，放射蟲含量較多的沉積物皆局限在臺東—綠島附近的海域，亦即曾有湧升流發現的區域。

PLATE 1

All figures are scanning electron micrographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers eited for each illustration.

1,7 ***Amphirhopalum ypsilon*** Haeckel
Scales = 134, 88 um, respectively. OR-87-02-01.

2,10 ***Amphymenium*** sp. A
Scales = 90, 66 um, respectively. OR-87-02-01.

3 ***Spongaster berminghami*** Campbell and Clark
Scale = 106 um. OR-87-01-14.

4 ***Heliodiscus echiniscus*** Haeckel
Scale = 113 um. OR-87-02-01.

5 ***Heliodiscus asteriscus*** Haeckel
Scale = 102 um. OR-87-02-01.

6,13 ***Larcopyle*** sp. cf. ***L. butschlii*** Dreyer
Scale = 90 um. OR-87-02-01.

8 ***Hexalonche aristarchi*** Haeckel
Scale = 90 um. OR-87-02-01.

9,17 ***Acrosphaera spinosa*** (Haeckel)
Scales = 65, 43 um, respectively. OR-87-01-14.

11 ***Collosphaera invaginata*** (Haeckel)
Scale = 73 um. OR-87-02-01

12 ***Siphonosphaera polysiphonia*** Haeckel
Scale = 46 um. OR-87-02-01.

14 Spumellaria gen. and sp. indet. A
Scale = 45 um. OR-87-01-14.

15,18 ***Ommatodiscus murrayi*** Dreyer
Scales = 56, 65 um, respectively. OR-87-02-01.

16 ***Heliosoma radians*** Haeckel
Scale = 83 um. ST1.

19 ***Spongodiscus resurgens*** Ehrenberg
Scale = 88 um. ST13.

PLATE 1

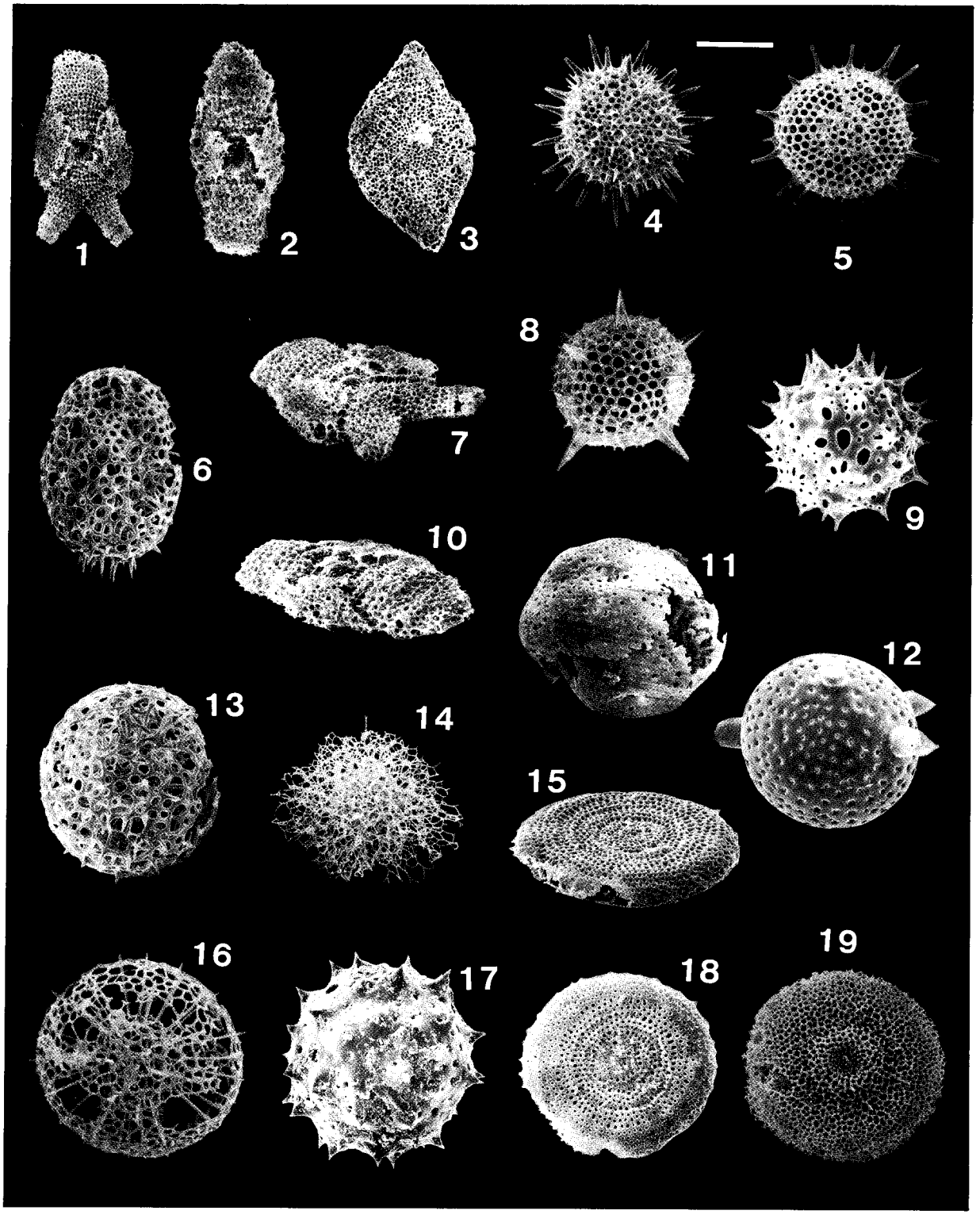

PLATE 2

All figures are scanning electron micrographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1 ***Ommatartus tetrathalamus*** (Haeckel)
Scale = 90 um. OR-87-02-01.

2 ***Tristephanium*** sp. A
Scale = 75 um. OR-87-02-01.

3,7,16 ***Tetrapyle octacantha*** Muller
Scales = 75, 75, 65 um, respectively. 3, lateral view, ST12; 7, lateral view, OR-87-02-01; 16, dorsal view, OR-87-02-01.

4 ***Tristephanium*** sp. B
Scale = 90 um. OR-87-02-01.

5 ***Ommatartus*** sp. B
Scale = 77 um. ST12.

6,14 ***Amphispyris*** sp. C
Scale = 60 um. OR-87-01-14.

8,11 ***Amphispyris costata*** Haeckel
Scales = 70, 56 um, respectively, OR-87-02-01

9,13 ***Amphispyris*** sp. A
Scale = 72 um. OR-87-02-01.

10 ***Tetrapyle*** sp. A
Scale = 70 um. OR-87-02-01.

12,15 ***Nephrospyris renilla*** Haeckel
Scales = 104, 113 um, respectively. OR-87-02-01.

17-18 ***Amphispyris*** sp. B
Scales = 75, 68 um, respectively. OR-87-01-14.

PLATE 2

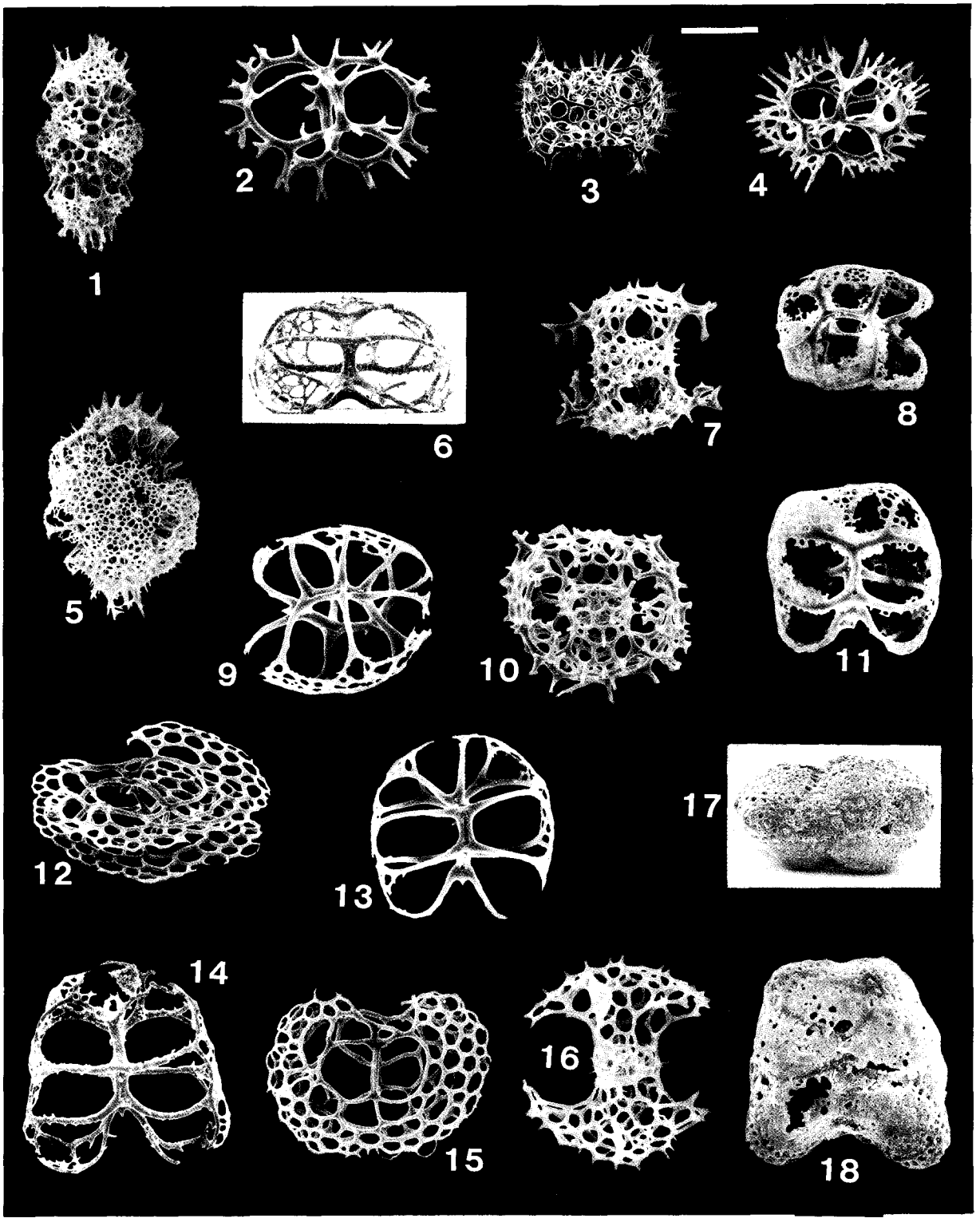

PLATE 3

All figures are scanning electron micrographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1 ***Euchitonia*** sp. A
Scale = 132 um. OR-87-02-01.

2,18 ***Euchitonia furcata*** Ehrenberg
Scale = 203, 136 um, respectively. OR-87-02-01.

3,10 ***Spongocore puella*** Haeckel
Scales = 102, 175 um, respectively. OR-87-02-01.

4-5,15 ***Hymeniastrum*** sp. A
Scales = 102, 100, 109 um, respectively. 4, OR-87-02-01; 5, ST12; 15, OR-87-01-14.

6,14,17 ***Euchitonia elegans*** (Ehrenberg)
Scales = 188, 155 um, respectively. 6, ST12; 17, OR-87-01-14.

7,11-13 ***Hymeniastrum euclidis*** Haeckel
Scales = 132, 124, 68, 75 um, respectively. 7, OR-87-02-01, 11-13, OR-87-01-14.

8-9 ***Hymeniastrum*** sp. B
Scales = 113, 100 um, respectively. OR-87-01-14.

16,20 ***Spongaster tetras tetras*** Ehrenberg
Scales = 121, 60 um, respectively. OR-87-01-14.

19 ***Hymeniastrum*** sp. C
Scale = 120 um. OR-87-01-14.

PLATE 3

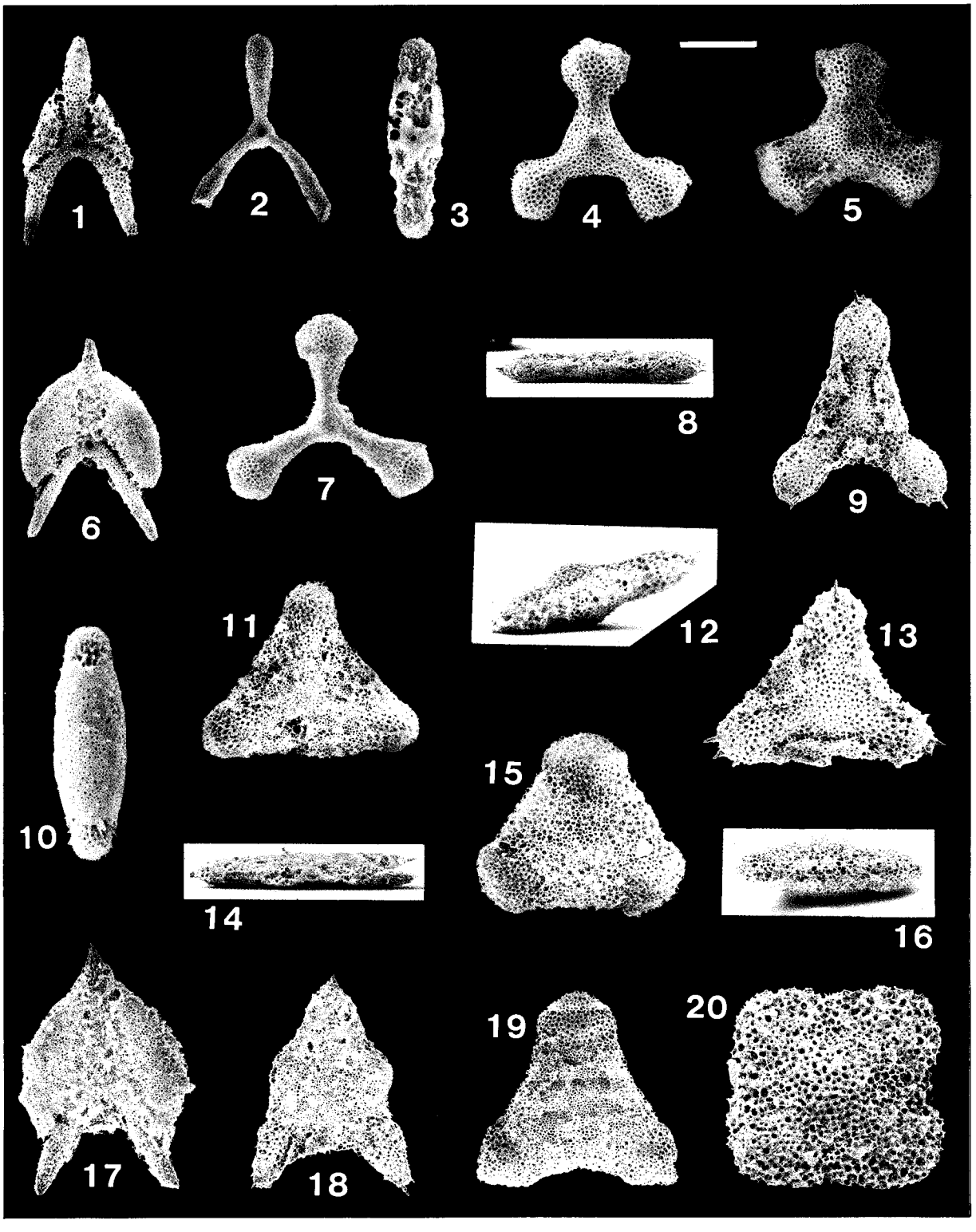

PLATE 4

All figures are scanning electron micrographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1 ***Pterocanium praetextum praetextum*** (Ehrenberg)
Scale = 88 um. ST1.

2 ***Pterocanium virgineum*** Haeckel
Scale = 90 um. OR-87-02-01.

3 ***Pterocanium orcinum*** Haeckel
Scale = 90 um. OR-87-02-01.

4-5 ***Eucyrtidium cienkowskii*** Haeckel
Scales = 75, 56 um, respectively. 4, OR-87-02-01; 5, ST1.

6 ***Callimitra*** sp. A
Scale = 120 um. ST12.

7 ***Conarachnium facetum*** (Haeckel)
Scale = 111 um. OR-87-02-01.

8,12 ***Cecryphalium sestrodiscus*** Haeckel
Scales = 100, 60 um, respectively. ST13.

9 ***Stichopodium dictyopodium*** Haeckel
Scale = 90 um. OR-87-02-01.

10-11 ***Lampromitra quadricuspis*** Haeckel
Scales = 88, 75 um, respectively. ST1.

13,17 ***Eucecryphalus geganbauri*** Haeckel
Scales = 56, 45 um, respectively. OR-87-02-01.

14,18 ***Lithopera becca*** Ehrenberg
Scales = 63, 55 um, respectively. OR-87-01-14.

15,19-20 ***Litharachnium*** sp. A
Scales = 120, 13, 75 um, respectively. ST1.

16 ***Lampromitra coronata*** Haeckel
Scale = 80 um. OR-87-02-02.

PLATE 4

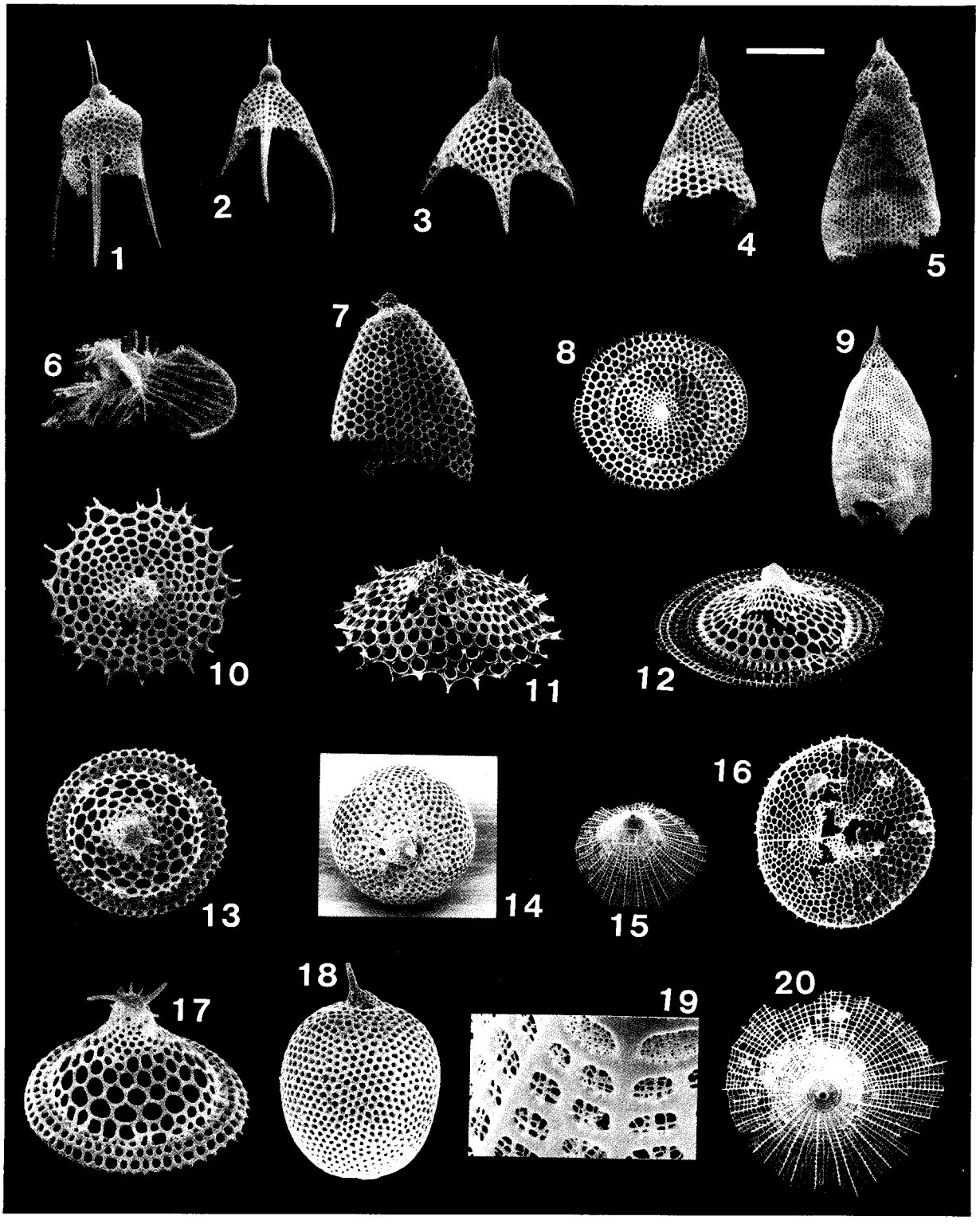

PLATE 5

All figures are transmitted light photographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1-2 ***Ommatartus tetrathalamus*** (Haeckel)
Scale = 87 um. ST12.

3-4 ***Ommatartus*** sp. A
Scales = 68, 71 um, respectively. ST12.

5-6,10 ***Ommatartus tetrathalamus*** (Haeckel)
Scale = 80 um. ST12.

7-8 ***Ommatartus*** sp. B
Scale = 80 um. ST1.

9,13 ***Ommatartus*** sp. B
Scale = 63 um. ST12.

11-12, 14-16 ***Lophospyris pentagona pentagona*** (Ehrenberg)
Scales = 54, 50, 68, 64, 61 um, respectively. ST12.

PLATE 5

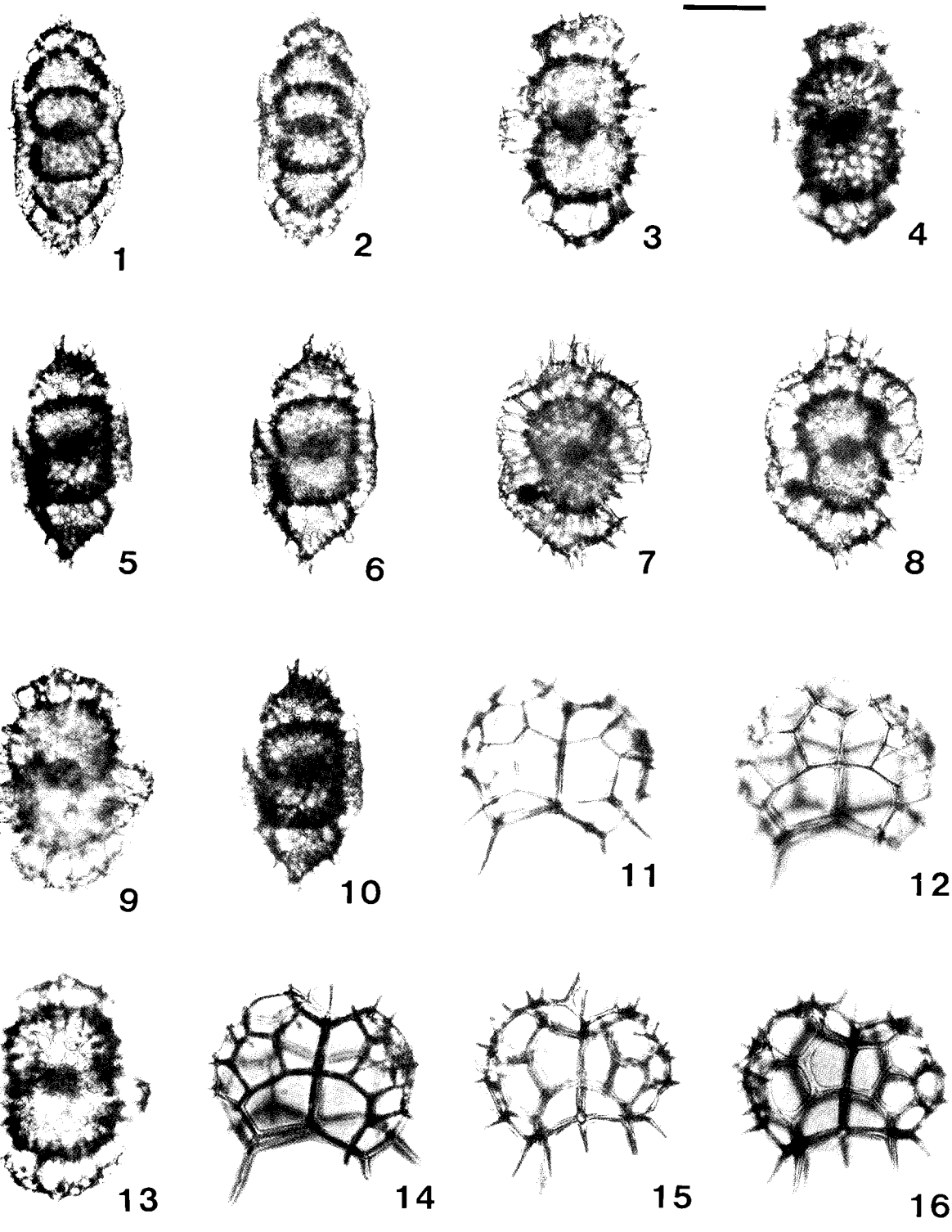

PLATE 6

All figures are transmitted light photographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1 ***Spongocore puella*** Haeckel
Scale = 72 um. ST12.

2-4 ***Euchitonia*** sp. B
Scales = 109, 105, 108 um, respectively. ST12. Note the differences in the preservation of patagium.

5 ***Euchitonia furcata*** Ehrenberg
Scale = 167um. ST13.

6 ***Euchitonia*** sp. C
Scale = 103 um. ST11.

7,13 ***Euchitonia elegans*** (Ehrenberg)
Scales = 123, 185 um, respectively. 7, ST11; ST13.

8 ***Amphirhopalum ypsilon*** Haeckel
Scales = 149, 125 um, respectively. ST12.

9 ***Hymeniastrum*** sp. B
Scale = 98 um. St11.

10 ***Hymeniastrum*** sp. A
Scale = 90 um. ST12.

11 ***Hymeniastrum euclidis*** Haeckel
Scale = 155 um. ST13.

12 ***Amphirhopalum virchowii*** (Haeckel)
Scale = 125 um. ST13.

14 ***Hymeniastrum*** (?) sp. D
Scale = 37 um. St12.

15-16 ***Hymeniastrum*** sp. E
Scales = 79, 105 um, respectively. 15, ST12; 16, ST13.

17 ***Spongaster tetras tetras*** Ehrenberg
Scale = 105 um. ST1.

PLATE 6

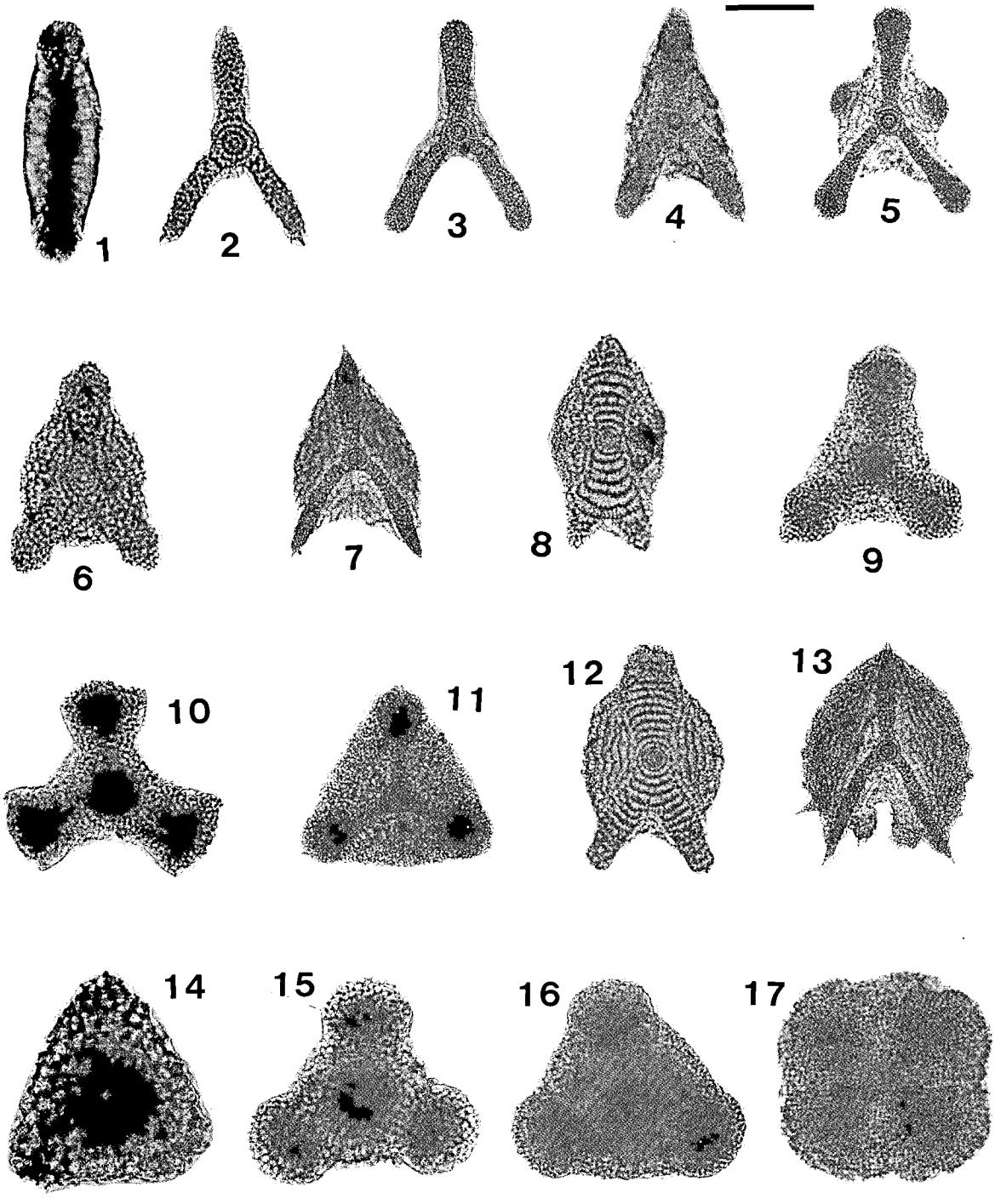

PLATE 7

All figures are transmitted light photographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1-2 ***Octopyle stenozona*** Haeckel
Scale = 115 um. ST1. Dorsal view.

3-6 ***Octopyle*** sp. cf. ***O. stenozona*** Haeckel
Scales = 57, 55, 142, 42 um, respectively. ST12. Dorsal view.

7-11 ***Amphispyris*** sp. A
Scales = 64, 64, 54, 54 and 51 um, respectively. 7-8, ST11; 9-11, St8.

12-15 ***Amphispyris*** sp. D
Scale = 55 um. ST12.

PLATE 7

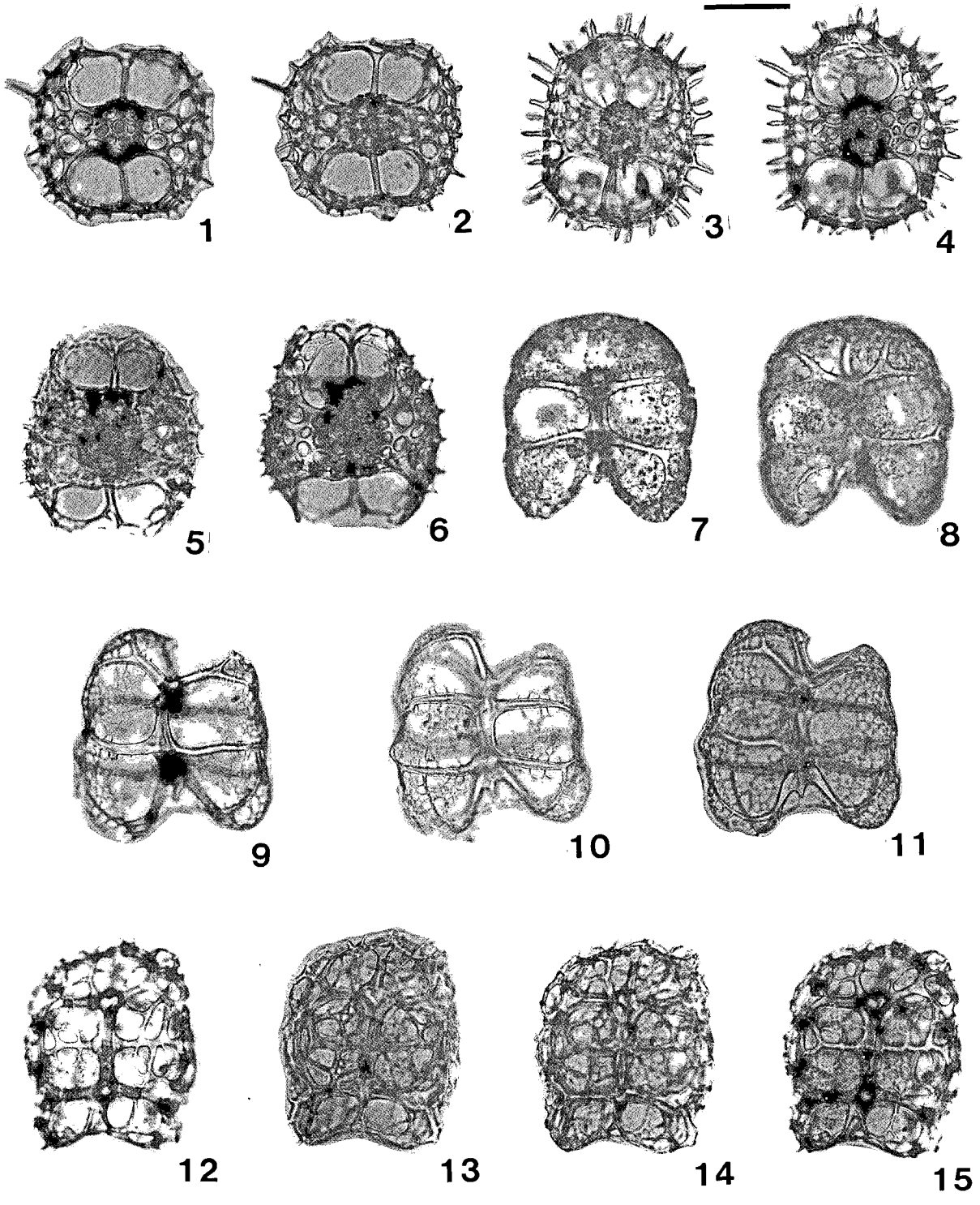

PLATE 8

All figures are transmitted light photographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1-2 ***Botryostrobus seriatus*** (Joergensen)
Scales = 60 and 70 um. OE-87-02-01.

3 Artostrobids gen. and sp. indet. A
Scale = 90 um. OR-87-02-01.

4-5 ***Eucyrtidium acuminatum*** (Ehrenberg)
Scales = 33 and 90 um. OR-87-02-01.

6 ***Hexacontium axotrias*** Haeckel
Scale = 71 um. ST12.

7-8 ***Amphispyris*** sp. C
Scale = 80 um. OR-87-01-11.

9 ***Amphispyris*** sp. B
Scale = 85 um. OR-87-01-11.

10 ***Collosphaera invaginata*** (Haeckel)
Scale = 48 um. OR-87-01-11.

11 ***Spongaster*** sp. A
Scale = 65 um. ST12.

12 ***Heliodiscus asteriscus*** Haeckel
Scale = 81 um. ST12.

13 ***Astrosphaera hexagonalis*** Haeckel
Scale = 113 um. ST12.

14 ***Acrosphaera spinosa*** (Haeckel)
Scale = 47 um. ST12.

15 ***Spongodiscus resurgens*** Ehrenberg
Scale = 75 um. ST1.

16-17 ***Actinomma arcadophorum*** Haeckel
Scales = 94, 99 um, respectively. ST8.

18 ***Trisolenia megalactis megalactis*** (Ehrenberg)
Scale = 36 um. ST12.

PLATE 8

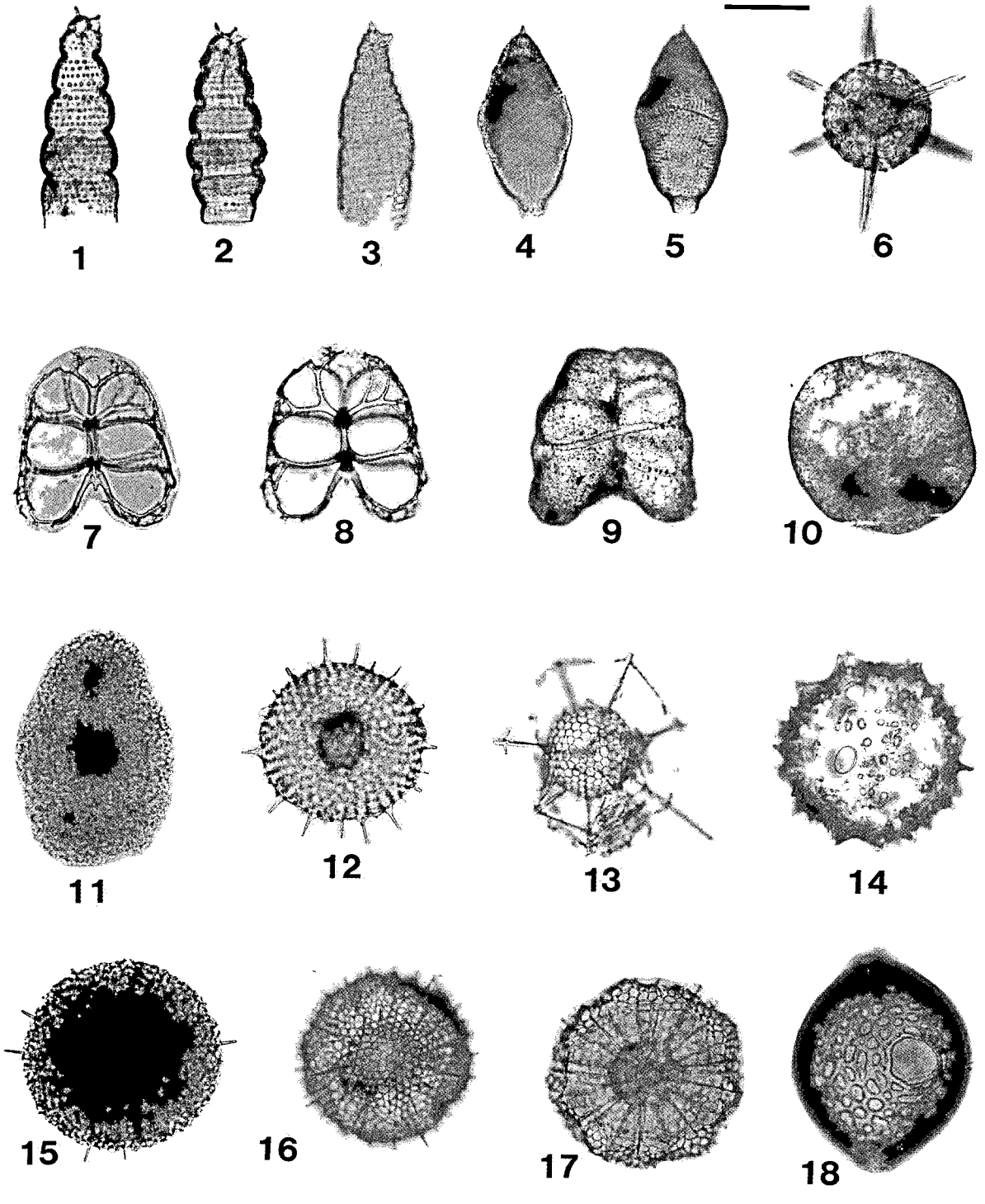

PLATE 9

All figures are transmitted light photographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1-2 ***Pterocanium virgineum*** Haeckel
Scale = 64 um. ST12.

3-6 ***Pterocanium praetextum praetextum*** (Ehrenberg)
Scale = 82 um. 3, 4, ST1; 5, 6, ST11.

7-8 ***Verticillata hexacantha*** Popofsky
Scale = 77 um. ST12.

9-10 ***Pterocanium orcinum*** Haeckel
Scale = 80 um. ST12.

11-12 ***Pterocorys campanula*** Haeckel
Scale = 90 um. ST12.

13-16 ***Eucyrtidium cienkowskii*** Haeckel
Scales = 72, 77, 59 and 63 um, respectively. 13, 14, ST11; 15, 16, ST1.

17 ***Spirocyrtis scalaris*** Haeckel
Scale = 77 um. ST12.

PLATE 9

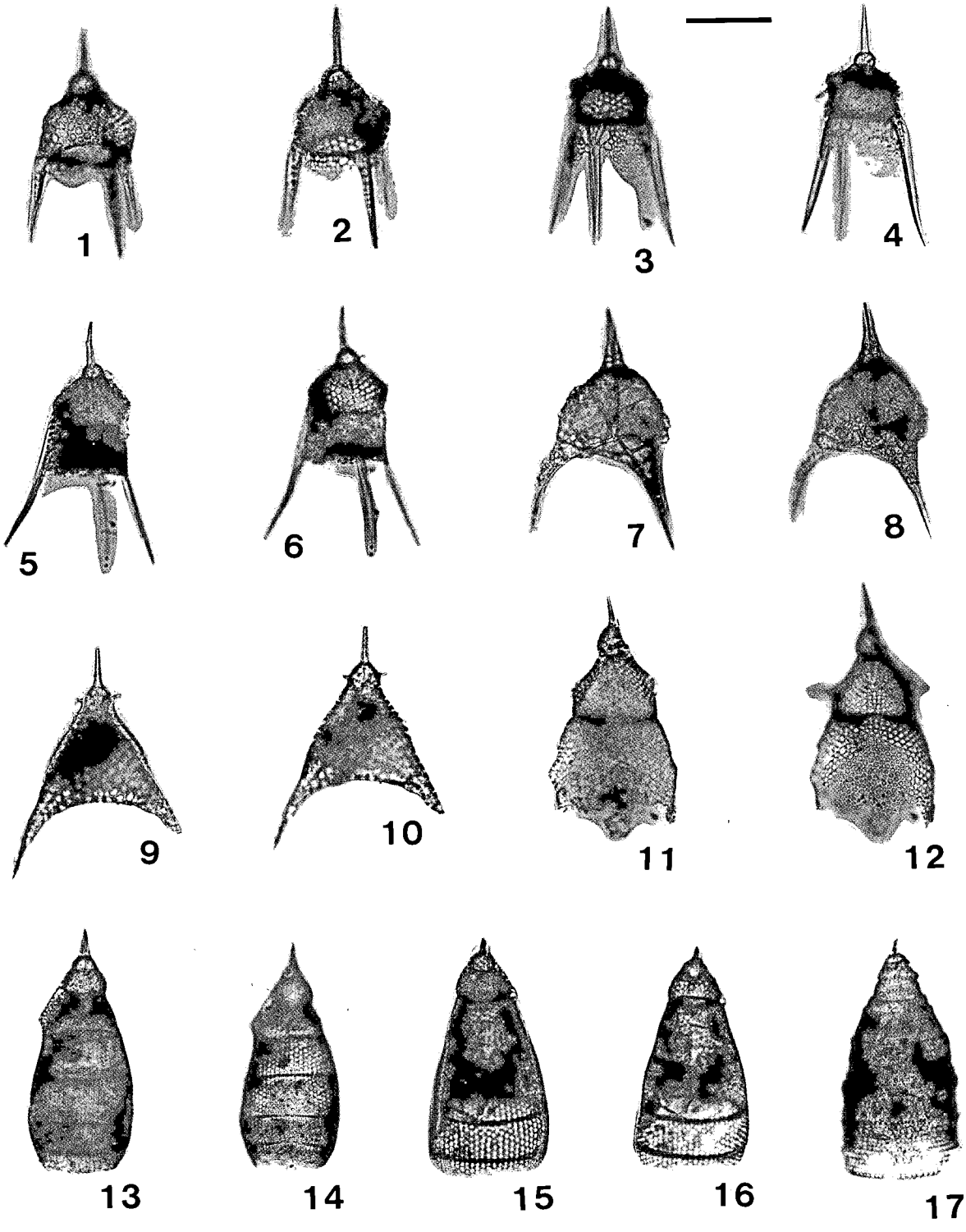

PLATE 10

All figures are transmitted light photographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1-2 ***Anthocyrtidium zanguebaricum*** (Ehrenberg)
Scale = 58 um. ST12.

3-4, 7-8 ***Acanthodesmia vinculata*** Muller
Scales = 64, 62, 73 and 68 um, respectively. ST12.

5-6 ***Anthocyrtidium ophirense*** (Ehrenberg)
Scale = 63 um. ST12.

9-10 ***Pterocorys*** sp. A
Scales = 62, 64 um, respectively. ST12.

11-13 ***Theocorythium trachelium*** (Ehrenberg)
Scale = 58 um. ST12.

14-15 ***Ommatodiscus murrayi*** Dreyer
Scale = 71 um. ST11.

16 ***Callimitra*** sp. A
Scale = 140 um. ST12.

17 ***Sethophormis*** sp. A
Scale = 64 um. St8.

PLATE 10

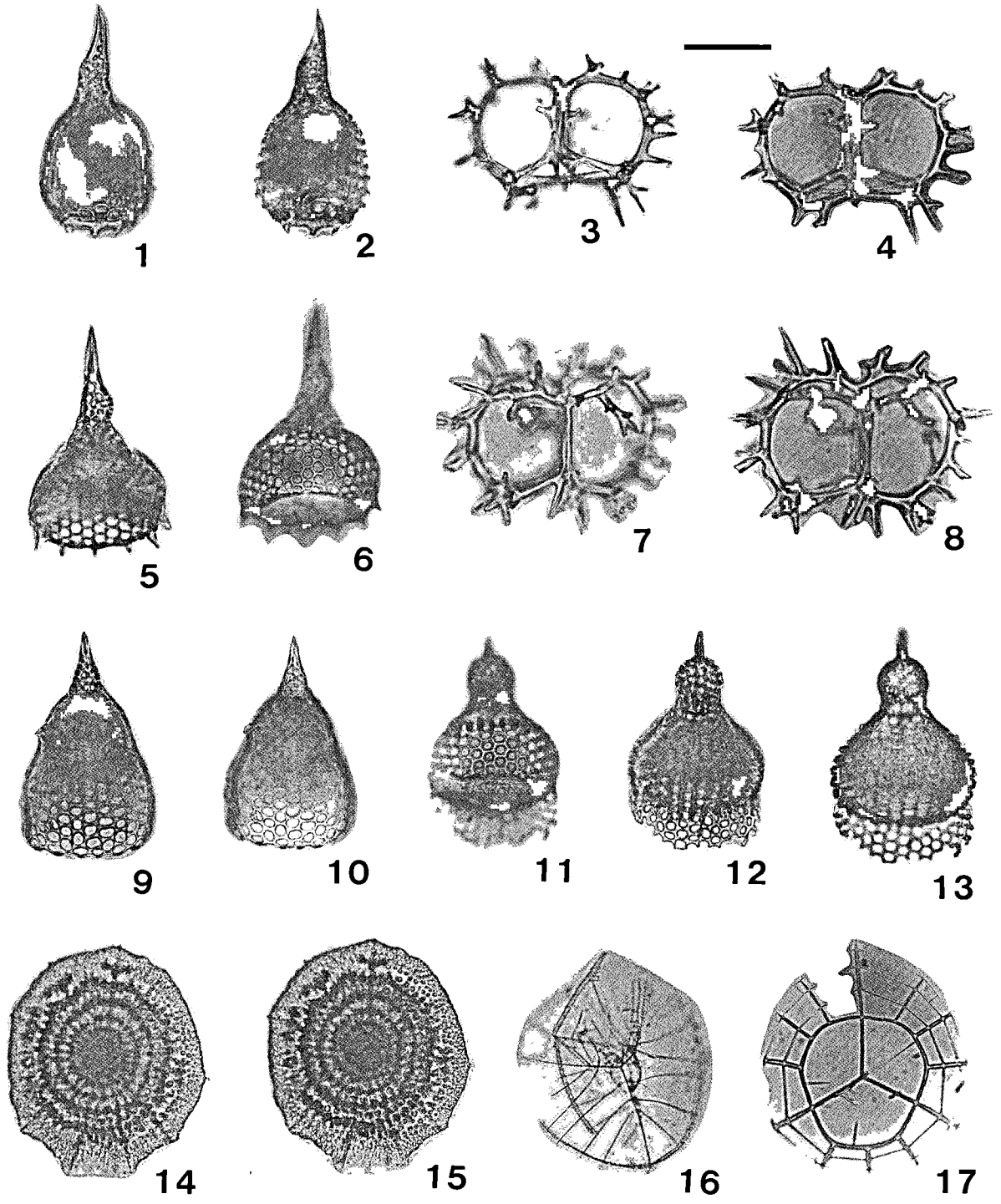

PLATE 11

All figures are transmitted light photographs of Recent Radiolaria from the west central Pacific Ocean near Taiwan. Length of scale bar, upper right, equals number of micrometers cited for each illustration.

1-3 ***Lampromitra quadricuspis*** Haeckel
Scale = 81 um. ST1.

4,8,12 ***Lampromitra coronata*** Haeckel
Scales = 115, 76 and 78 um, respectively. 4, ST12; 8, 12, ST11.

5-7, 14-16 ***Cecryphalium sestrodiscus*** Haeckel
Scales = 88, 83, 83, 68, 68 and 14 um, respectively. 5, 6, 7, ST13; 14, 15, 16 ST1.

9-11 ***Litharachnium*** sp. A
Scale = 78 um. ST1.

13 ***Eucecryphalus geganbauri*** Haeckel
Scale = 63 um. ST13.

PLATE 11